

M.Sc. 4th Semester Examination, 2024

ELECTRONICS

PAPER – ELC-403(A&B)

Full Marks : 50

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

PAPER – ELC-403(A)

(RF and Microwave Systems)

GROUP – A

Answer any **four** questions : 2 × 4

1. Draw the two-valley model of transfer electron device. How negative resistance is achieved ? 1 + 1
2. Draw the equivalent circuit of tunnel diode. What is its' input impedance . 1 + 1
3. What are the S-matrix of E-plane Tee and H plane Tee. 1 + 1
4. What is gyrator ? What is the S-matrix of an ideal gyrator ? 1 + 1
5. What is slow wave structure ? Give an example. 1 + 1
6. How negative resistance is obtained in an IMPATT diode ? 2

GROUP-B

Answer any **four** questions : 4 × 4

7. State and prove Floquet's theorem. Draw the W - B diagram and show the allowed and forbidden region. $1+2+\frac{1}{2}+\frac{1}{2}$
8. A transmitter has an EIRP (Effective isotropic radiated power) of 200W at 100 MHz. What is the power received by the receiving antenna, if there is a path loss of 163 dB and the receiving antenna has an efficiency of 80% and directivity of 17 dB in the direction of the received beam ? 4
9. Deduce an expression for the Hull's cut-off voltage of a magnetron. 4
10. Show that bandwidth & Q -factor of a resonator is inversely proportional to each other, $BW = \frac{1}{Q}$. 4
11. Design a 100Ω branch-line quadrature hybrid junction at the frequency of 2.4 GHz. 4

12. (a) What are monostatic and bistatic radar ?

(b) A radar is operating at 12 GHz having antenna gain 20dB. The transmitted power is 3 kW (pulse power). If radar cross section is 10m^2 & minimum detectable signal is $P_{\min} = -80$ dBm, find the maximum range of the radar.

1 + 1 + 2

GROUP - C

Answer any two questions : 8 × 2

13. Find expression for symmetrical and antisymmetrical couplers. Give examples of both .

3 + 3 + 1 + 1

14. (a) Find the S-parameters of Wilkinson power divider.

(b) Design a equal split Wilkinson power divider for 50Ω system impedance at freq. 1.8 GHz.

5 + 3

15. Draw schematic diagram of a two-cavity Klystron. Find an expression for the bunching parameter of two-cavity Klystron. 2 + 6
16. Find the resonant frequency of a rectangular cavity resonator. What is the resonant frequency of a square cavity of dimension 4cm at its fundamental mode. 5 + 3

[Internal Assessment – 10 Marks]

PAPER – ELC-403(B)

(Renewable Energy)

GROUP – A

Answer any **four** questions : 2 × 4

1. Explain work-energy theorem. 2

2. What do you understand by conservative and non-conservative forces ? 2
3. Classify the energy sources. 2
4. What is carbon footprint ? 2
5. Mention the causes of global warming. 2
6. Define air mass for solar radiation. 2

GROUP-B

Answer any **four** questions : 4 × 4

7. Draw and explain the energy flow diagram of the earth. 2 + 2
8. Describe the role of energy in social transformation. 4
9. Explain energy trilemma index. 4

10. What do you mean by renewable and non-conventional energy sources ? Give two examples for each case. $2 + 1 + 1$
11. Mention the energy sources in India. What is National Green Tribunal (NGT) act ? $2 + 2$
12. Explain solar photovoltaic and solar thermal conversions. $2 + 2$

GROUP - C

Answer any two questions : 8×2

13. What are the origins of fossil fuels ? Why do we need to use new and renewable energy sources ? What is ecological footprint ? $2 + 4 + 2$
14. Explain the air and water pollutions due to energy production. $4 + 4$

15. Show the equivalent circuit of p-n junction solar cell. Draw the I-V characteristics of the solar cell at different temperatures. Define fill factor and efficiency of a solar cell.

3 + 3 + 1 + 1

16. Name the sources of biomass. Mention the characteristics of biomass. How the biomass is converted into fuel ?

2 + 3 + 3

[Internal Assessment — 10 Marks]
